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ON THE METRIC SYSTEM of WEIGHTS and MEASURES

By

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This pamphlet by Prof. Dupuis is the outcome of a recent article by him on the Metric System in the "Queen's Quarterly," which appealed so strongly to me that I asked him to be kind enough to elaborate it and allow me to give his views a wider circulation than was possible through a University magazine. I am also glad to include in the pamphlet contributions by three other well-known writers on the subject—Mr. S. S. Dale, of Boston; Mr. F. A. Halsey, of New York, and Mr. George Moore, Secretary of the British Weights and Measures Association.

J. P. MURRAY.

Toronto, April 20, 1907.

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INTRODUCTORY.

Prof. Dupuis' clear and logical paper in defence of British standards should be distributed widely. It is especially important that it be read by every legislator and official charged with the regulation of our weights and measures.

The great value of the British system depends on the fact that it is the established standard throughout the English-speaking world. The regulation of these weights and measures is the common duty of all English-speaking countries. Each political division may have the power, but in a higher sense has no right, to change its established system without the concurrent action of all. Thus the Congress and the President of the United States have the legal power to regulate the weights and measures of that country, but their highest duty is to take no important step without the concurrence of all English-speaking countries. Without the approval of Canada or Australia neither the United States nor the United Kingdom, nor both of them in concert, should undertake to change our established standards of weight and measure.

Furthermore, the English-speaking world, acting in concert, is limited in its action by the duty it owes to posterity. The experience of Continental Europe makes it certain that a determined and long-continued attempt to change the basic standards of the British system by force would result in a confusion that would last for centuries, probably for ever, certainly for a period of which no one can predict the end. The law-makers of the English-speaking world would rest under the heavy obligation to attempt no change in our weights and measures unless the change is certain to benefit posterity. As illustrations of such permissible changes

D944

may be mentioned the elimination of superfluous units, leaving us one ton (of 2,000 pounds) instead of two; one hundredweight (of 100 pounds); one gallon (of 10 pounds); and one bushel. That policy would result in our leaving the British system better than we found it.

The plan to organize a commission representing all English-speaking countries to study our weights and measures is excellent, providing all changes in the size of the fundamental British standards are eliminated from consideration; also, providing their work is limited to investigation and recommendation, and action is reserved for the elected representatives of the people. Any proposition to refer to a commission the question of changing our basic standards, whether to the metric or any other basis, should meet with uncompromising opposition.

SAMUEL S. DALE.

Boston, Mass., April 10, 1907.

ON THE METRIC SYSTEM OF WEIGHTS AND MEASURES.

If any justification is needed for the appearance of an article like the present on the metric system, it is to be found in the facts that in many countries the metric system has been made compulsory by legal enactment; that there are several other countries where the system is not yet compulsory, but legally permissible; that the advocates of the system are at the present time very active in their efforts in both Great Britain and the United States, countries in which as yet the system is only permissive, to make it the only allowable usage, and that the time is presumably not far distant when the people of these countries will find it necessary to decide for themselves, or to allow their governing bodies to decide for them, as to whether in their weighings and measurings they are to continue to use the good, old and well-tried system of their forefathers, or whether they are to learn a new and so-called scientific system, with foreign standards and foreign names.

The lands to which the eyes of the metricists are turned to-day are the two great English-speaking domains of Great Britain and her colonies and the United States of America. Their strong hope is that could they win over these to their side the triumph of their cause would be complete, and over the length and breadth of the civilized and commercial world such familiar words as inch, foot, yard, pound, gallon, etc., would, in a generation or so, have passed into oblivion, and no sound would be heard or known in the practical art of weighing and measuring except those belonging to and forming a part of the metric system.

That they would see the full fruition of their hope is, however, more than doubtful. Instead of that uniformity for which they had labored so hard they would be more likely to see endless confusion, for the struggle between the old and the new would drag its objectionable form throughout the present century, if not longer.

This may be what the future has in store for humanity; but when we consider the seriousness of such an outcome—an outcome from under whose influence and control it would be forever impossible to escape—it becomes necessary to take no leap in the dark, but to know exactly what we are doing and what the consequences are to be. It is proper and necessary, then, that while those who are strong believers in the advantages of the metric system should be allowed to present their arguments in favor of its adoption, so, also, those who see grave faults in the system and difficulties in the way of its general and compulsory adoption, should voice their objections in as forcible a manner as possible, consistent with what is reasonable and true.

Opposition to Compulsion.

That the conflict between the metricists and the anti-metricists is now on is evidenced by the fact that strenuous efforts have been made in Great Britain to get an Act passed making the use of the metric system compulsory, and that a considerable number of the members of the British Parliament were committed to it. But the Act did not pass, and in the meantime, those who were not willing that it should pass, seeing that it would probably pass in the near future if they remained inactive in the midst of the great activity of their opponents, formed a strong and representative association, called the "British Weights and Measures Association," the purpose of which is to preserve, and, where practicable, to improve the present system of British weights and measures. And thus the conservatism of the British people, which has so often saved the nation from embarking on foolish or doubtful schemes, now stands in the way of the forcible commitment of the people to a proposition which is foreign to all their past experience, and which would to a considerable extent separate them from the education and experience of the earlier years of their life, and deprive them of the full use of a large quantity of material which has been stored up for them by their forefathers.

Something of the same kind has taken place in the United States, and in that country also there is an influential organization designed to resist the compulsory introduction of the metric system, and also to assist in any improvement which may appear to be desirable and practicable in the current British system.

Canada's Mistake.

Canada, however, seems to have taken, or is about to take, a different course. The Canadian Government thought that it would be well to send a lecturer among the people to inform and enlighten them upon the merits of the metric system, as if to prepare them for the reception of this system into the industrial and commercial activities of the country. Accordingly, a professor from Toronto University was supplied with paraphernalia and commissioned to go around amongst the people to instruct the educated and to enlighten the ignorant as to the particular merits of the metric system.

What Canada has to gain by this movement, or why she should take so much pains and spend so much of the people's money to initiate it, it is difficult to understand. Does she desire to show to other and older nations how advanced she is in modern thought by showing that she is ready to adopt any new thing which bears the name of progress, whether its real character be progressive or not? Or does she purpose giving a sop to France, the mother of the metric system, or to that portion of France which is domiciled within Canadian boundaries? At any rate, she might have appointed to the work of explaining the system to the people—if, indeed, such an explanation was at all necessary—not a metricist of most pronounced views, but some qualified person, who would feel at liberty to point out not only the merits, but also the demerits of the system.

If Great Britain and the United States, the great English-speaking peoples of the world, were to adopt the metric system it would be not only right, but even necessary for Canada to do so. But it is not easy to see what Canada has to gain in following a course which in a way tends to separate her from her two most powerful friends. And it is scarcely to be credited that a people numbering only 6,000,000 can expect to set the pace for over 120,000,000.

That Great Britain is not ready to adopt the metric system is evidenced by the fact that quite recently the British Parliament rejected a bill proposing to make the metric system compulsory.

If Canada is anxious to do something in the matter it might be well for her to give some attention to the present movement in the United States as expressed in a bill introduced into the House of Representatives by Mr. Towne. This bill prepares for a commission, to be made as representative as possible, and to be empowered to consider and investigate not only the metric system, but the whole question of weights and measures, and to invite Great Britain, and hence her colonies, to join forces with the United States in the investigation. Such a commission would evidently arrive at such conclusions as would be worthy of serious consideration.

Wisdom.

Well, the Parliamentary lecturer came and took up his parable, and gave a description of the difficulties of commercial dealing many years ago, when nearly every municipality had its own system of weights and measures. He told of the gradual merging of separate municipalities into one, and of the consequent assimilation and unification of their various commercial usages, and of the increased facilities for exchange resulting therefrom; and, owing to the tremendous increase in the trade and commerce of nations, it was becoming essential—indeed, had become essential—that the varied systems of the world should, as speedily as possible, be replaced by some one orderly system.

From any part of this statement we have no reason for dissenting, as there can be no doubt that one general system of measuring and weighing throughout the world would be a considerable incentive to increased trade between nations, and in this way a benefit to the trader, and probably to the whole community, if all other restrictions could be removed.

But we do dissent when he tells us that this one universal system must of necessity be the metric system.

Why the Metric System?

And why the metric system? Because, according to our lecturer, the metric system is the scientific one, and, therefore, the only complete, simple and orderly one; that it is purely decimal throughout; that its use is so widely spread, and is compulsory in so many countries, that somewhere about four hundred millions of people are now employing it, and that a system which, solely by its merits, has recommended itself to so large a proportion of the world's population, must of necessity in time become universal, so that we might as well accept the inevitable now as at any other time, and get acquainted with the system which in future we will be compelled to employ.

This is a very specious argument, and the statements which it embodies may be taken to be true if we modify them considerably, and make them with a number of reservations.

As to the nature and claims of the metric system, these will be dealt with fully hereafter. Suffice it to say here that in the first place, if we except France and Germany, the remaining nations employing the metric system in their daily life do not figure to any great extent in the manufacturing and commercial world, and are not, therefore, in a position to very materially influence the trade policy of the leading and more influential nations.

Manufacturers Oppose It.

In the second place, the two largest manufacturing and commercial peoples in the world, Great Britain and the United States, do not employ the metric system in their manufacturing processes or their trade relations, and that Great Britain and her dependencies alone are nearly or quite as populous as all the countries with a compulsory metric system. And then we have all the Russias and several other countries, for Russian length measures are founded upon the English inch.

In the third place, it is doubtful if there is a country in the world, even amongst those in which the metric system has been made compulsory, in which departures from the system are not common amongst what we may call the commoners of the people. One reason for this will be considered hereafter; and even in the manufacturing industry in France itself it is not unusual to hear such names as **denier, aune, livre, sous,** etc., words which denote measures not belonging to the metric system, and yet this system has been, or is supposed to have been the standard system of France for the past century and over.

This is certainly not a very hopeful showing for the country which produced the metric system, and in which it has been the only legal system for so long a time. And how can a person believe that the case would be any better were the metric system made compulsory in Great Britain and the United States, countries teeming with records which recognize only the British units, and to which the metric system and all belonging to it are foreign?

Time no Cure.

It has been well said by Samuel S. Dale, of Boston, Mass.: "The attempt to introduce the metric system into France began 114 years ago, when her industry and commerce were in a comparatively primitive condition. All the conditions were favorable to success because of the limited use of weights and measures. The attempt has failed there in spite of these favorable conditions and the forcible means adopted to make the French people use metric standards. In the face of this experience, how is it possible to change the weights and measures of English-speaking people, who now number

140,000,000, as compared with 25,000,000 in France in 1790, who inhabit or control 14,000,000 square miles of the earth's surface as compared with 200,000 miles covered by France in 1790, and who are leaders in a highly developed and complicated system of industry and trade as compared with the primitive conditions in France when the metric system was established?"

And yet some people think, or profess to think, that it requires nothing but the pronunciation of the talismanic words, "the metric system," to change the usages and ideas of the two greatest nations in the world.

The Scientists' Hobby.

In the fourth place, it is exceedingly doubtful if the metric system was ever introduced into any country on account of its intrinsic merits as seen from the point of view of the masses. Wherever it has been introduced it was simply forced upon the people without their wishes in the matter being consulted or their consent being asked. The scientists saw fit, rather hastily, as some of us think, to adopt the metric system as their particular system of weights and measures—not all scientific men, but the majority of them, and especially the chemists and physicists, and, having committed themselves to it, they appear to be ill at rest until they have brought their fellow-citizens under its sway.

Now, science does not depend upon the metric system, or upon anything belonging to any particular system, but is the same science under all systems; and hence we cannot help thinking that, to some extent, the adoption, by British and American scientists, of the metric system, with its foreign nomenclature and units, was something of the nature of an unfortunate fad.

Moreover, even though the metric system may be convenient for those scientists who have the greater part of their important records yet to make, it must be remembered that the scientists number only a very small part of the whole community; that they are, in general, neither manufacturers, nor producers, nor traders; that they are not largely interested in those records of the past which fill the British archives, and depend for their value upon the inviolability of the British standards; and that they usually know little, and often care less, about the usages and the conveniences of the great majority of the people, who cannot enter into the spirit of their science.

The Scientists' Ability.

No one, for a moment, doubts the importance of science as an element in our civilization and a potent force in the modern development of the world. But it is quite possible that past successes have somewhat turned the scientific head, and that the scientist may overrate his ability to regulate advantageously the usages of the manufacturing and commercial world.

However this may be, it is not the agriculturist, or the manufacturer, or the merchant that clamors for a change to the metric system. But it is manifestly the scientist, who urges on the legislator, and the latter, knowing little of the merits of any system, and having confidence in the wisdom of his advisor, and being quite willing to be credited with the appearance, if not able to boast the reality of being truly scientific, is too often ready to impose upon the people some new and radical idea proceeding from the fertile scientific brain without due consideration as to what it may lead.

Accuracy of the Metre.

Again, the lecturer took pains to impress upon his audience the importance of the metre as a unit of length. He entered fully into details as to the labor and care that had been bestowed upon the formation of the standard bar which is kept at the Bureau des Longitudes in Paris, and which is marked by two very fine lines or points, whose distance apart is exactly one metre. He said that some people objected to the metre as a unit of length because it professed to be one-ten-millionth part of the distance from the equator to the pole, measured along a meridian, and that it is not exactly what it professes to be. And he went on at some length to show that such an objection is hypercritical when we consider the difficulties of the case and the wonderful closeness of the approximation.

Moreover, he told us that the French bar had become a standard by which to calibrate and adjust the English foot.

But he did not tell us that the idea of taking the ten-millionth part of the distance from the equator to the pole as a standard unit of length was a foolish one. And he did not show us that any advantage whatever results from taking this particular measure as our unit-length, or that its adoption by the savants of the French Revolution was anything more than a fanciful idea. Nor did he refer to the fact that any bar of constant length, whatever that length may be, would serve equally well with the French one by which to adjust the English foot or any other unit of length required.

To do these things would not have served his purpose, which was to magnify the importance of the metre in the minds of his hearers.

Useless Labor.

The story of the fixing of the length of the metre may be very interesting as a history of labors undertaken and of results achieved, but it is wholly irrelevant to the subject under discussion, which is, as to whether or not the metre is intrinsically worthy of being forced upon the English-speaking people of the world.

It matters not how much time and expense were lavished upon the bar in the Bureau des Longitudes; it matters not whether the distance thereon recorded is the ten-millionth or the eleven-millionth, or any other millionth of the meridional quadrant. What does matter, and very seriously, is that the metre is an anarchical and radical unit, incommensurable with all previous units, and, therefore, out of harmony with all.

The metre as a standard of length has no advantage whatever, practically or theoretically, over the inch, or the foot, or the yard, and all that the metrical advocates can say or do cannot make it otherwise. But the British units have been worked into the very tissue and fibre of the civilization and work done in Great Britain and the United States and Russia, and all countries employing the British inch as a standard.

Confusion in Records.

The results of the great national surveys which have taken long years of time and cost large sums of money, are all recorded in British units in both Great Britain and America. The lands, as divided up and apportioned among the people, are registered in acres, and the acre is a plot 8 rods by 20 rods, and contains exactly 43,560 square feet. In terms of the much-lauded metre this would be expressed as a plot 36.93 metres by 92.33 metres, or containing 3,409.75 square metres, and the expression is then only approximate.

The trigonometric maps, plans and charts of the country are worked out and laid down to scales having a relation to the British inch, and the factory and machine shops throughout the land have their machines and varied appliances arranged to work to the same unit; and the metre is out of harmony with these units.

Fancy, then, the incongruity of introducing a new unit, which would throw into interminable confusion all the most valued and important measurement records of the past life and work and history of the people!

And then the lecturer endeavored to show how easy and unshocking it would be to change from the British to the metric system, an operation which would be practically unfelt and almost unknown by the masses of the people.

Thus a boy is sent for a pound of sugar. The dealer gives him half a kilogram, and the mother says: "Why, we get more sugar for a pound than we have been accustomed to"; and that is practically about all there would be of it.

Not many intelligent people are likely to be deceived by such arguments and illustrations. To ask for a pound, and get a half kilogram, or to ask for a ton and receive 1,000 kilograms, is not the introduction of the metric system, and has no very definite relation to it.

Enforced Perplexity.

The compulsory enforcement of the metric system would have results so far reaching as to affect every person in the land, and even the language which they speak. The good, efficient and monosyllabic words, inch, foot, yard, mile, pint, quart, ounce, pound, etc., would be relegated to oblivion, never to be heard of again outside of history, and their places would be filled, nay, more than be filled, by such uncouth compound and polysyllabic words as millimetre, centimetre, hectolitre, milligram, decigram, etc., in great variety.

And finally, our lecturer told us that if we wish to understand science we **must** learn the metric system, for that is the only system in which the results of scientific observations are recorded. And, moreover, owing to the large number of nations now committed to the metric system, its use is bound to become universal in the near future, and that we might as well accept the inevitable at once and with a good grace.

To the first of these statements it may be replied that the man in the street is not likely to be influenced by this argument. He cares nothing for science except as an amusement or a pastime, and respects the results of scientific investigation only in so far as these results administer to his comfort or his pleasures.

Not Needed in Science.

But, reading between the lines, we judge that the lecturer would have us infer that the scientific world has adopted the metric system once and finally, and that its one aim is to convert the rest of the world to its views, inasmuch as there can be no science outside the metric system. Well, we have no quarrel with such a view, even if we do not believe it true. Faraday, and Davy, and Joule, and Tyndall, and many other noted scientists did remarkably good scientific work on the British system of units, and none of their successors have shown better results with their foreign system. And with all respect we submit that it would be easier for British and American scientists to revert to the system of former days than for the masses interested in the industrial and commercial pursuits of the two nations to change over to a foreign and non-acceptable system.

As to the second contention, even if it be true, that the use of the metric system is bound to become universal, that is no reason why those who believe that the change to the metric system would be unfortunate should not oppose such a change to the utmost of their ability. They are contending for liberty of action and against that paternalism which would saddle the nation with a compulsory usage in which they do not believe.

Majority Against the Metre.

As regards the widespread usage of the metric system, we cannot do better than quote from a recent British writer, who says: "When the metric advocates are beaten on all other points they invariably fall back on the sentimental idea of having one language for weights and measures throughout the world. They point out that thirty-six out of the thirty-nine civilized nations have already adopted the metric system, and it is only common justice that the minority, British Empire, United States, and Russian Empire, should give way to the majority.

"That looks very plausible, but what of the relative importance of these countries? Taking those thirty-six nations in order of population, none of the first four have the population of Liverpool. Lancashire has more inhabitants than any of the first eighteen. The total of the first twenty-four is only equal to the population of the United States. There is a larger population within fifty miles of Manchester town hall than in any one of the first twenty-five of those nations. The Russian Empire has a population equal to the whole of the first twenty-eight, and the British Empire has four million more people than the first thirty-four added together. Counting the three against the thirty-six, we have 567,000,000 against 445,296,000, and the measures of those 567,000,000 are all based on the English inch. Looking at the question from the point of view of trade and commerce, the Anglo-Saxon race alone has a pre-eminence which makes the vaunted position of metre-users ridiculous."

Having thus far dealt with the arguments of the lecturer, let us turn to the metric system itself and to the claims made for it by its advocates.

The metricist believes, or appears to believe, that the metric system is perfect, and that its adoption would at once and forever remove all difficulties and incongruities in the practical art of weighing and measuring. It is not difficult to point out the imperfections in his system, but he does not see them, or, if he does see them, he does not manifest any tendency or desire to remove or correct them. One would think that, instead of wasting so much energy in trying to get others to see perfections which are not there, he would try to bring his system as near to perfection as possible, by removing every objectionable feature.

Decimal not Limited.

The point the metricist mostly dwells upon is that the metric system is decimal, and, therefore, lends itself to ease in computation. But this does not justify the adoption of an arbitrary and incommensurable unit and several other objectionable features to be found in the system. A decimal system may easily be framed without the incongruities which characterize the metric one.

Our money system in Canada and the United States is a decimal one, but outside of this it has very little relation to the metric system.

But let us go to the root of the matter. Humanity is burdened with the decimal system of notation because some primitive ancestor of the Vertebrates divided its extremities into five parts. But this does not make the system by 10 a natural or a profitable one, or remove any of its inherent objectionable features., for amongst the even numbers below 20, the only base **worse** than 10 would be 14, and all the others would be better. The value of a base depends upon the characters of its even divisors. Ten offers only 2 and 5. But every even number would offer 2, and 5 is of little account as being very seldom needed. What the common people want is something that will give halves and quarters. A base of 12, on the other hand, gives us 2, 3, 4 and 6, the most important divisors conceivable. And hence a duodecimal system has eminent advantages over a decimal one in regard to its power of expression.

It may be said that this is irrelevant to the discussion, since our numeral system **is** founded on 10, and must ever remain so. Admitting this to be the case, we should remember that we have other measures to consider besides merely those pertaining to lengths and weights and those related thereto; and we should not close our eyes to the fact that the decimal system has its limitations, and sometimes very inconvenient limitations, which do not belong to a duodecimal one. Computation is not everything, and in some cases other considerations are far more important than mere ease of computation.

A Natural Unit.

In the measurement of length we have no natural unit, and we are thus at liberty to choose the one that may suit us, and hence there was no necessity for taking such a unit as the metre. But in the measurement of rotation and its result—angle—this is not the case. The natural unit which **must** be taken into consideration is the complete rotation or circum-angle. The framers of the metric system did not attempt to divide this into one hundred parts, because natural circumstances were against it. The circum-angle must, unless we wish to court confusion, be divided into four parts, as the right angle is the most prominent of all angles in practical applications.

However, they tried hard to indulge their decimal proclivities by dividing the right angle into one hundred parts. But after some exasperating experience this scheme failed. The angle next in importance to the right angle is that of the equilateral triangle, which is two-thirds of a right angle, so that, rationally considered, the right angle must be divided into thirds. Now, it is well known that it is **not possible** to express thirds of the unit by means of a decimal system. Here, then, the decimal system of division fails; for we must necessarily divide our natural unit first into four parts, and then each of these parts into three, thus giving us, at first hand, a duodecimal division.

Without considering the further division of the angle, we have gone far enough to see that if we are to have simplicity with effectiveness we **must** retain a duodecimal system in the division of the angle, and hence in geometry, astronomy, navigation and surveying. So that the cry of the universality of the metric system, or, in fact, of any decimal system, is somewhat in vain.

So, also, in the division of time. Time is measured out by the rotation of the earth on its axis, and as a consequence has a relation to rotation and to angle, and must, to avoid confusion, be measured by the same or a cognate system.

Chronometers to be Decimalized.

One metricist, however, predicts that it will not be many years before angle and time will both fall under the sway of the ubiquitous metric system. That time will come when the astronomer and the navigator have become about as crazy as the metricist.

We have seen, then, that the decimal system contains inherent defects from the point of view of the needs of humanity, and that a universal decimal system is out of the question. Let us now consider the metric system.

First, its unit. Was there any sufficient or cogent reason for assuming such a radical unit as the metre is, incommensurable with all known units, except the purely fanciful one of making it to have a definite relation to the dimensions of the earth? But this idea was not only fanciful, it was foolish; for the earth's dimension is not a fixed quantity, and probably never will be as long as man remains upon it.

Would it not have been far better to take as a unit some length having a simple and fixed relation to those units in which work had formerly been done and records made? Any intelligent person can readily see how much less confusion would have resulted from a change made under the latter conditions. The metre does not differ very much from the British yard, and the yard, taken as a unit of length, would be far more acceptable to English-speaking people than the one which the metricist seeks to impose upon them.

In our opinion, the English-speaking nations and those who have been accustomed to employ the English standards will make an irreparable blunder if they agree to accept the metric system with its present fanciful unit, a unit which, while possessing decidedly objectionable features, has little or nothing to recommend it.

Nomenclature.

Next, consider the nomenclature. The idea in the nomenclature of the metric system is to have one unit, and all other measures connected with this unit so named as to express their relations to the unit. This, of course, at least as far as name goes, prevents the taking as a unit any measure except the one having the unit name. Now, this is a great mistake. In the English system of length measures, the inch, or the foot, or the yard, or the mile, may with equal propriety be taken as the unit, because there is nothing in the name to prevent it. Or taking, as illustration, that system to which the metricist is so fond of referring as an example of the metric system, the money system of Canada and the United States. Here, again, the cent, or the dime, or the dollar, may equally well be taken as a unit, because the very nomenclature favors such a usage. But the cent-dime-dollar system is not a part of the metric system; for if it were, we would call the cent a centi-dollar if the dollar is to be considered as the unit, or we would speak of the dollar as a hecto-cent if the cent be taken as unit. Under like circumstances the dime would become either a deci-dollar or a deka-cent.

This is a plain illustration of the fact that our money system is not metric, even though it is decimal. Besides, if the money system were metric, one would think that it would be uniform in metre-using countries, as, of all kinds of measuring, it should be the one most easily unified. But every traveller knows from troublesome experience that nothing like uniformity exists.

But the money system of Canada and the United States is certainly an excellent one, and one from which the metric system would do well to copy. To do this, however, several material changes would have to be made.

In the first place, the fact of the system being decimal is quite sufficient to connect the various measures numerically, so that to make the nomenclature indicate this is not only a useless but an objectionable piece of work. Such names as decimetre, centimetre, etc., should be replaced by names as simple and distinctive as cent, dime, dollar. In this respect the British system is far superior to the metric one, being approximately perfect. There is no possibility of making a mistake between such short, crips terms as inch, foot, yard, pound, ton, quart, etc., whereas millimetre and kilometre are too long to be forcible and too much akin in sound to be readily distinguishable; and so, also, are dekametre and decimetre, with the **c** pronounced hard.

School and the Metre.

Some metricists are fond of advancing the exaggerated and silly argument of the amount of time wasted by a child in learning the elements of the British system, as if the only purpose in education were to acquire that which is immediately practicable, whereas much more time would be lost in writing and speaking these long, uncouth names throughout a lifetime.

Besides, the time spent by children in learning to work in a numerical system other than the decimal is far from being wasted. Quite the reverse: it is time spent in a capital mathematical exercise. And it may be safely said that a person never really understands any numerical system until he knows and has worked with more than one. A purely decimal system has a tendency to introduce into calculations a dead uniformity, and thus to destroy that very versatility which a proper education should foster. And even if no system other than the decimal should ever be required in practice, that is not a sufficient reason for dropping all other systems from a proper scheme of education. But, as has already been pointed out, some other system is required in Geometry, Trigonometry, Astronomy, etc. So that the loss of time argument is very far from the truth and possesses no force whatever.

In the second place, by employing short monosyllabic and distinct names for the several measures, any one of them could be considered as the unit as required by the exigencies of the case. And this would in itself be a great improvement.

Even as it is, the metre-using physicist does not express the height of the barometer, for example, in metres, but in millimetres, so that he choses to take for his unit this long word of eleven letters and four syllables, whereas under a better nomenclature he might easily employ a word of only one syllable and of four or five letters. Some will undoubtedly say that we can use the contraction mm. But this is a slovenly mode of writing, and it cannot help us in speaking.

About Co-relation.

In the third place, the metricist is fond of telling us of the simple connections between the units of length, capacity and weight in his system. Well, let us see. In a system pretending to be founded on advanced scientific principles, the square on the unit of length as side should be the unit of area, and the cube on the unit of length as edge should be the unit of volume as well as of capacity, while the unit of weight should be that of one unity capacity of water.

But this is not the case in the metric system; and it is not easy to see why the framers of the system, with their radical views, should depart so far from an acknowledged scientific principle. As it is, it is just about as difficult for a beginner to remember the connection between a metre and a litre, or a metre and a gram, as it is to remember that one gallon of water weighs 70,000 grains.

Now, this whole source of trouble would be avoided by adopting names such as would do away with the idea of any one definite unit; for the litre and gram would then be no longer connected directly with the metre, but with two other distinct units, and the metre would be but one of the units in the system.

Again, the framers of the American system were of the opinion that they were establishing a purely decimal system when they adopted the names and denominations, mill, cent, dime, dollar, and eagle. But what are the facts? The mill is never used in counting money, but only in estimating percentages; the dime has practically fallen into disuse, because it is simpler and shorter to say thirty-seven cents than to say three dimes and seven cents; and large sums of money are never counted in eagles, but in dollars; so that the system has gradually drifted from a decimal system into a centesimal one.

Objections of the Decimal.

Now, the same kind of change is sure to take place in any decimal system, so that it is doubtful whether the scheme might not better be made centesimal to begin with.

The objections to the metric system as now pointed out must be obvious to every unbiased, intelligent person. But whether they will influence the metricist to make any effort to remove them is quite another matter.

In conclusion, we wish to put ourselves on record as not opposing a decimal system, but rather favoring one if an unobjectionable one can be devised, provided always that the limitations of the decimal system be recognized, and it be not, therefore, made compulsory for all measurements. We do not admire the complexity and irregularity of the present British system, but we would sooner adhere to that, with all its vagaries and pecularities, than accept the metric system as it stands now, because, if once accepted, there would thereafter be little or no hopes of any reasonable reform.

The English-speaking people are safest in continuing to adhere to their present system until some other can be devised which is decimal, if it must be, and reasonable, and does not violate the public respect for past records to so great an extent as the metric system does, and to this purpose the English-speaking world should address itself. In fact, those who have in the past employed the British and American system are now put upon their mettle. As yet they outnumber the metricists, and it is now for them to say whether they will sink their individuality in the metric system or devise and give to the world a better one.

SUPPLEMENTARY.

INDUSTRY OPPOSED TO THE METRIC SYSTEM.

So far from the metric system being universal in most countries, as claimed by the metric advocates, there is not a single country in the world in which it is universal. Thus there is not a metric country in the world in which lumber is sawn to the millimetre, the inch being the universal unit of measurement in the lumber industry. There is not, in the world, a woolen mill nor a silk mill which manufactures its product by the metric system, nor is there a cotton mill using the metric system as a basis of manufacture, except in France, and the apparent exception in France is not a real one, since the system used in the cotton mills of France is an incongruous mixture, in which the metre is the long and the old French inch the short unit of length.

There is not a country in the world in which the metric system has become the common one in trade and commerce except by compulsion. Fourteen countries have been identified in which every effort has been made to induce the people to adopt the system by first adopting it for Government purposes. But in every case they persist in using their old system in their everyday trade and commerce. This means that with the supposed advantages of the metric system constantly before them, for periods of time ranging from twenty years to over a hundred years, the people, by adhering to their old units, have refused to recognize it.

Every other great improvement in the history of the world has come into use because of its advantages being manifest; and it has been adopted by the people spontaneously. But here we have the remarkable condition that millions of people, with the supposed advantages of the system constantly before them, refuse to recognize those advantages. This could not be the case if the supposed advantages were real.

The metric party is composed almost exclusively of scientific men and teachers. The anti-metric party is composed of manufacturers and the great public. In fourteen countries, which are always classed as metric by the metric party, the people have condemned the system by refusing to use it; and in Great Britain and the United States the manufacturers have condemned it by the stoutest opposition to its adoption, for it is a fact that in both these countries the manufacturing industries are practically a unit in opposition to the system. This opposition is explained by the metric party by saying that the manufacturers "do not understand the subject." Was there ever a more pretentious piece of arrogance? The metric party, composed of men who have no knowledge of manufacturing, pretend that they are the ones who understand the effect of the introduction of a new system of measurement into manufacturing industry, and that the manufacturers are ignorant. It should not be necessary to say that the contrary is the case. The metric party have never shown the slightest knowledge of the effect of such a change upon manufacturing industry, and have scarcely attempted to discuss it. It is they who are ignorant, and in their ignorance they seek to lead. Knowing nothing of the effect of their measure and having nothing at stake, they endeavor to force it upon others, who must pay the cost. They say it will cost but little; the manufacturers declare it will cost untold millions. Who knows best? The reader must judge.

F. A. HALSEY.

505 Pearl St., New York,
April 18th, 1907.

BRITISH vs. THE METRIC SYSTEM OF WEIGHTS AND MEASURES.

The article written by Dean N. F. Dupuis on this subject admirably sums up the shortcomings of the metric system. It makes pointed reference also to what appears to have been an unfortunate action taken by Canadian Government officials in sending out a public lecturer charged with the duty of advocating a system which almost all practical people in the English-speaking race object to.

In that article the writer well describes the object of the British Weights and Measures Association, of which I have the honor to be Secretary, as being that of "preserving, and where practicable improving, the present system of weights and measures." Now that we have defeated the pro-meterists in Parliament, reducing their "over 400 pledged supporters" to 118 by a short educational propaganda, there may be an opportunity for us to do some work of a constructive character. Such work has been delayed principally by the efforts of pro-meterists, who have, for far too long a time, been throwing dust in the eyes of English-speaking peoples by their advocacy of a retrograde system of weights and measures. These people apparently overlook the fact that the prime object of weights and measures is to weigh and to measure, and not to facilitate calculations. Looked at from this point of view, there is nothing in the metric system, or even in any decimal system of weights and measures, that does, or can, commend itself to manufacturers, and, although the Canadian Parliamentary lecturer, as pointed out by Dean Dupuis, informed his audiences that the metric system had recommended itself to a large proportion of the world's population "solely by its merits," such a statement does not appear to be in accord with the facts in any one country as regards manufacturers; neither is the statement correct as regards trade in any country, for, instead of "recommending itself" to any nation, it has, in every case, been thrust upon that nation by bureaucratic Governments at the suggestion of quasi-scientific advisors.

The remark of Dean Dupuis that astronomers and navigators will not use the metric system for measurements of angles and time until they become "as crazy as pro-meterists," reminds me of the very peculiar position which Lord Kelvin holds in this respect. Admitting that there is no great living scientist than Lord Kelvin, and no greater living man who better understands the laws of navigation, we have this peculiar result: As a scientist he says the metric system is perfect; as a navigator he says it is impossible! If we take all professions and businesses in such proportion as that, then, even on Lord Kelvin's own admission, the metric system is only useful for half of them and impossible for the other half; but I think it would be very difficult even for such a learned man as Lord Kelvin himself to prove that outside science there is any profession or business which cannot be carried on equally well, if not better, on the British system, or, as regards science, that it is impossible to improve on the metric system.

What is now required of the English-speaking peoples, whose mission in life it is

> "To teach the nations how to live,"

is for an effective organization of practical people to be started in each English-speaking country, and for all these organizations to have interchange of opinions and experiences, added to all they can learn from the experiences of other peoples, as regards the usages of weights, measures and coinage, with a view to the ultimate adoption of one uniform system.

Geo. Moore.

25 Victoria St., London, S.W.,
April 16th, 1907.